PCM2702

Integrated Circuits
Special Applications

ELEKTOR ELECTRONICS
DATASHEET 12/2000

Specifications

At T_A = +25°C, V_{CC} = $V_{CC}L$ = $V_{CC}R$ = $V_{CC}P$ = 5.0V, V_{DD} = $V_{DD}C$ = 3.3V, fS = 44.1MHz, signal frequency = 1kHz and 16-bit data, unless otherwise specified.

PARAMETER		CONDITIONS	PCM2702E			UNITS
			MIN	TYP	MAX	
RESOLUTION				16		Bits
HOST INTERFACE			Supports USB Revision 1.0, Full Speed			
DIGITAL AUDIO FORMAT						
Audio data Format			USB ISOCHRONOUS OUT			
Audio Data Bit Length				16		
Audio Data Channel				1, 2		
Sampling Frequency (fS)				32, 44.1, 48		
DIGITAL INPUT/OUTPUT						
Input Logic Level	V_{IH} (1)		2.0			VDC
	V_{IL} (1)				0.8	VDC
	V_{IH} (2)		0.7 V_{DD}			VDC
	V_{IL} (2)				0.7 V_{DD}	VDC
Input Logic Current	I_{IH} (1)	V_{IN} = V_{DD}		+65	+100	µA
	I_{IL} (1)	V_{IN} = 0V			±10	µA
	I_{IH} (2)	V_{IN} = V_{DD}			±10	µA
	I_{IL} (2)	V_{IN} = 0V			±10	µA
Output Logic Level	V_{OH} (3)	I_{OH} = – 1mA	2.8			VDC
	V_{OL} (3)	I_{OL} = + 1mA			0.5	VDC
DYNAMIC PERFORMANCE (4)						
THD+N at V_{OUT} = 0dB				0.002	0.005	%
THD+N at V_{OUT} = –60dB				1.2		%
Dynamic Range		EIJA, A-Weighted	96	100		dB
Signal-to-Noise Ratio		EIJA, A-Weighted	100	105		dB
Channel Separation			98	103		dB
DC Accuracy						
Gain Error				±1.0	±3.0	% of FSR
Gain Mismatch, Channel-to-Channel				±1.0	±3.0	% of FSR
Bipolar Zero Error		V_{OUT} = 0.5 V_{CC} at BPZ		±30	±60	mV

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16-Bit Stereo Digital-to-Analog Converter with USB Interface

Manufacturer

Burr-Brown, P.O. Box 11400, Tucson, AZ 85734, USA. Internet: http://www.burr-brown.com

Features

Integrated USB interface:
  Full-Speed Transceiver Supports 12Mbps Data Transfer.
  Fully Compliant with the USB 1.0 Specification.
  Adaptive Mode for Isochronous Transfer.
  Self-Powered Device.
Accepts 16-bit stereo and mono USB audio data streams.
Analog performance (V_{CC} = 5V):
  Dynamic Range: 100dB (typ. at 16-bit)
  SNR: 105dB (typ.)
  THD+N: 0.002% (typ. at 16-bit)
  Full-Scale Output: 3.1V_{pp}
8x oversampling digital filter:
  Passband: 0.454f_S
  Stopband: 0.546f_S
  Passband Ripple: ±0.002dB
  Stopband Attenuation: –82dB
Sampling rate (f_s): 32kHz, 44.1kHz, 48kHz
On-chip clock generator with single 12MHz clock source
Multi-Functions:
  Digital Attenuator: 0dB to –64dB, 1dB/step
  Soft Mute
  Zero Flag
  Suspend Flag
  Playback Flag
Dual Power Supplies:
  +5V for Analog portion
  +3.3V for Digital portion
Package: SSOP-28

Application Example

USB Audio DAC, *Elektor Electronics* December 2000.

Applications

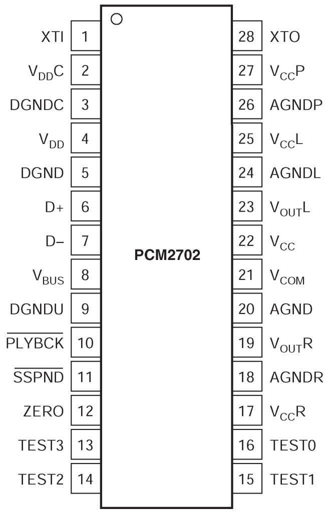
Stand-alone USB audio speakers
CRT/LCD integrated USB audio speakers
USB audio amplifiers
Other USB audio applications

Description

The PCM2702 is a single chip digital-to-analog converter offering two D/A output channels and an integrated USB 1.0 compliant interface controller. The newly developed SpAct™ (Sampling Period Adaptive Controlled Tracking) system recovers a stable, low-jitter clock for internal PLL and DAC operation from the USB interface audio data.

The PCM2702 is based upon Burr-Brown's Enhanced Multi-level Delta-Sigma Modulator, an 8x oversampling digital interpolation filter, and an analog output low-pass filter.

The PCM2702 can accept a 48kHz, 44.1kHz and 32kHz sampling rates, using either 16-bit stereo or monaural audio data. Digital attenuation and soft-mute features are included, and are controlled via USB audio class request.



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PIN	NAME	TYPE	DESCRIPTIONS
1	XTI	IN	Crystal Oscillator Input. (1)
2	$V_{DD}C$	—	Digital Power Supply for Clock Generator, +3.3V.
3	$D_{GND}C$	—	Digital Ground for Clock Generator.
4	V_{DD}	—	Digital Power Supply, +3.3V.
5	D_{GND}	—	Digital Ground.
6	D+	IN/OUT	USB Differential Input/Output Plus.
7	D –	IN/OUT	USB Differential Input/Output Minus.
8	V_{BUS}	IN	USB Bus Power (this pin NEVER consumes USB bus power). (2)
9	$D_{GND}U$	—	Digital Ground for USB Transceiver.
10	$\overline{\text{PLYBCK}}$	OUT	Playback flag, active LOW (LOW: playback, HIGH: idle).
11	$\overline{\text{SSPND}}$	OUT	Suspend flag, active LOW (LOW: suspend, HIGH: operational).
12	ZERO	OUT	Zero flag (LOW: Normal, HIGH: ZERO.)
13	TEST3	IN	Test pin 3. Connect to digital ground. (2)
14	TEST2	IN	Test pin 2. Connect to digital ground. (2)
15	TEST1	IN	Test pin 1. Connect to digital ground. (2)
16	TEST0	IN	Test pin 0. Connect to digital ground. (2)
17	$V_{CC}R$	—	Analog Supply for R-channel, +5V.
18	$A_{GND}R$	—	Analog Ground for R-channel.
19	$V_{OUT}R$	OUT	Analog Output for R-channel.
20	A_{GND}	—	Analog Ground.
21	V_{COM}	—	DC Common-Mode Voltage for DAC.
22	V_{CC}	—	Analog Supply, +5V.
23	$V_{OUT}L$	OUT	Analog Output for L-channel.
24	$A_{GND}L$	—	Analog Ground for L-channel.
25	$V_{CC}L$	—	Analog Supply for L-channel, +5V.
26	$A_{GND}P$	—	Analog Ground for PLL.
27	$V_{CC}P$	—	Analog Supply for PLL, +5V.
28	XTO	OUT	Crystal Oscillator Output.

Notes: (1) 3.3 V tolerant. (2) Schmitt trigger input with internal pull-down, 5V tolerant.

PARAMETER		CONDITIONS	PCM2702E			UNITS
			MIN	TYP	MAX	
ANALOG OUTPUT						
Output Voltage		Full-Scale (–0dB)		62% of V_{CC}		V_{p-p}
Center Voltage				50% of V_{CC}		V_{DC}
Load Impedance		AC-Load	5			kΩ
DIGITAL FILTER IMPEDANCE						
Passband		±0.002dB			$0.454f_S$	
Passband		–3dB			$0.490f_S$	
Stopband			$0.546f_S$			
Passband Ripple					±0.002	dB
Stopband Attenuation		Stopband = $0.546f_S$	–75			dB
Stopband Attenuation		Stopband = $0.567f_S$	–82			dB
Delay Time				$34/f_S$	11	s
ANALOG FILTER PERFORMANCE						
Frequency Response		At 20kHz		≠0.02		dB
POWER SUPPLY REQUIREMENTS						
Voltage Range	V_{DD}, $V_{DD}C$		±3.0	±3.3	±3.6	VDC
	V_{CC}, $V_{CC}L$, $V_{CC}R$, $V_{CC}P$		±4.5	±5.0	±5.5	VDC
Supply Current	I_{DD}	$V_{DD} = V_{DD}C = 3.3V$		22	30	mA
	I_{CC}	$V_{CC} = V_{CC}L = V_{CC}R = V_{CC}P = 5.0V$		18	25	mA
Power Dissipation	P_D	$V_{DD} = V_{DD}C = 3.3V$ and $V_{CC} = V_{CC}L = V_{CC}R = V_{CC}P = 5.0V$		165	225	mW
TEMPERATURE RANGE						
Operation Temperature			0		70	°C
Storage Temperature			–55		+125	°C
Thermal Resistance, Θ_{JA}		SSOP-28		100		°C/W

NOTES: (1) Pins 8, 13, 14, 15, 16: VBUS , TEST3 TEST2 TEST1, TEST0. (2) Pin1: XTI. (3) Pins 10, 11, 12, 28: PLYBCK, SSPND, ZERO, XTO. (4) The dynamic performance is based upon ideal host signal quality, and may vary according to the system. Dynamic performance specifications are tested using a Shibasoku #725 THD Meter with 400Hz HPF, 30kHz LPF, Average Mode, and 20kHz Bandwidth limiting. The load connected to the analog output is 5kΩ, or larger, via AC coupling.